WONDERS
OF THE
GREAT MAMMOTH CAVE
OF KENTUCKY

JAS. W. TURNER

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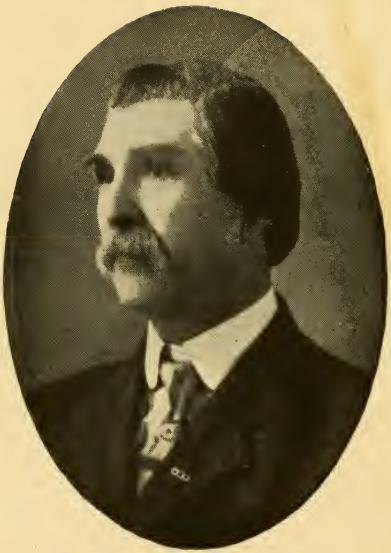

JAS. W: TURNER

WONDERS

OF THE

GREAT MAMMOTH CAVE

OF KENTUCKY

CONTAINING THOROUGH AND ACCURATE HISTORICAL AND DESCRIPTIVE SKETCHES OF THIS MARVELOUS UNDERGROUND WORLD, WITH A CHAPTER ON THE GEOLOGY OF CAVE FORMATION.

BY

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SUPERINTENDENT OF CITY SCHOOLS,
Carrier Mills, Illinois.

WITH ILLUSTRATIONS

1912

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TO

THE MEMORY OF

A DEPARTED FATHER AND MOTHER, BOTH NATIVES OF KENTUCKY, THE STATE IN WHICH IS LOCATED THE GREAT SUBTERRANEAN WONDER HEREIN DESCRIBED, THIS LITTLE VOLUME IS AFFECTIONATELY DEDICATED

BY THE AUTHOR.

PREFATORY

This book has been written principally because of the high appreciation the author entertains for the beauties and sublimities of nature, and for his love for historical writing. Another object has been to give useful and entertaining literature to the youth of our country, especially to the hosts of young men and young ladies who have been his pupils within the past half century.

The historical sketches contained in the book have been gathered with great care from the most reliable sources, and can be relied upon as being practically correct. The marvelous scenes within the cave have been described exactly as they appealed to the writer while touring its avenues and channels, and none of these pictures have been in the least overdrawn.

Chapter I. is principally historical, and contains sketches of the discovery of the cave, the manufacture of saltpeter within its avenues, animal and vegetable life within the cave, the hotel, ownership, life-tenants and heirs of the Mammoth Cave estate.

Chapter II. is descriptive, and contains sketches of the scenes in routes one and two combined. One of the most sublime of these scenes is the famous Star Chamber.

Chapter III. is also descriptive, and contains descriptions of the scenes in routes three and four combined. In this chapter is included the description of the boat ride on Echo River, and the sublime effect of its wonderful and marvelous echoes.

Chapter IV. is geological, containing brief accounts of the processes by which the earth's crust has been formed, and the chemical processes of cave-making in limestone regions.

Acknowledgments are due to the Mammoth

Cave management for favors and courtesies extended to the author, and especially to Albert Covington Janin, of Washington, D. C., trustee of the Mammoth Cave estate, for permission to use some historical matter from advertising circulars, and for his kindness in furnishing names relative to the ownership, life-tenants, and heirs of the Mammoth Cave estate. Acknowledgments are also due to the guides, Edward Biship, Joshua Wilson, Robert Lively, and William Bransford, for special favors and valuable information.

Carrier Mills, Ill., Dec., 1912. J. W. T.

WONDERS OF THE GREAT MAMMOTH CAVE

CHAPTER I.

HISTORICAL.

AWAY down in "Old Kentucky" are the possibilities of a delightful and profitable outing, as new and refreshing as fancy could conceive or heart could wish—a place where tradition holds sway; where extortion and gouging and graft and bluff and exploitation are unknown; where there is an endless variety of "types;" where expense bills are less than expected, and where a dollar goes as far as two in other places; where the gong of the electric car and the honk-honk of the automobile are sounds unheard; where glaring signboards, electric displays, amusement parks and their kind are wanting—a place where one can get "back to Nature's heart."

DISCOVERY

This wonderful place, this modern Eden, is the famous Mammoth Cave of Kentucky, the greatest known cavern in the world. This marvelous underground world was discovered by John Hutchins in 1809. Hutchins, who was a famous hunter, of the Daniel Boone kind, had wounded an enormous bear, and while pursuing his wounded game was led to the mouth of the cave, which the bear entered, and which Hutchins explored for only a short distance, but far enough to realize something of its immense size.

At this time the entrance was obstructed by the fallen trunks of trees and loose rocks, over and through which Hutchins and his wounded bear climbed until bruin was safely within his lair. Hutchins reported his discovery of the cave, but no definite explorations were made for two or three years, and then only for a distance of a few miles from the entrance.

SALTPETER WORKS

The first explorations revealed the fact that

great quantities of nitrous earth, from which saltpeter is made, covered the floor of the cave. This discovery led to the purchase of the cave by parties who, in a short time, began the erection of saltpeter works within, at places not far distant from the mouth of the great cavern. These crude works were completed, and the manufacture of saltpeter was begun just before the beginning of our second war with Great Britain in 1812.

GUNPOWDER

During this war the Americans were sorely in need of gunpowder, and as saltpeter is one of its principal ingredients, there was a great demand by the government for all the saltpeter that these works could possibly produce; and it is said that the promoters of the enterprise reaped an immense fortune from its sale during the war. It is also claimed that the cause of the Americans would have failed in the conflict had it not been for the home manufacture of saltpeter in the Mammoth Cave during the war, as all for-

eign supplies had been shut out by the strict and general embargo.

Powder made from the material taken from the Mammoth Cave had just been furnished to Capt. Bainbridge, of the "Old Ironsides," when

"Her thunders shook the mighty deep"

in that brilliant victory over the British fleet off the coast of Brazil. Commodore Perry's fleet of nine vessels had been supplied with powder from the same source just before he met the hostile fleet near the west end of Lake Erie in September, 1813. The world knows the result of that desperate encounter. Perry was enabled to send his famous dispatch, "We have met the enemy and they are ours." The same powder was used by General Jackson's famous Kentucky and Tennessee riflemen when they won undying fame for their marksmanship in the memorable victory at New Orleans.

The fires of patriotism were kindled anew in our bosom when, in July, 1908, we first visited the cave and looked upon these old works,

and reflected that here was made the material that enabled the Americans to drive British oppression from the seas and gain the commercial privileges and freedom that we so highly cherish today.

At the close of the war the embargo was raised, and as saltpeter could then be imported from other countries and sold at a much lower rate than it could be produced here, the works were abandoned, and have never been used since. Owing to the dryness and purity of the atmosphere in the cave the remains of these old works are still in a good state of preservation, and the tourist sees them today practically as they were left by the saltpeter miners almost a century ago.

LEACHING VATS

These primitive works consisted principally of wooden hoppers, or vats, each about eight feet wide, twelve feet long, and four or five feet deep. Into these leaching vats was poured the nitrous earth obtained from the various avenues,

rooms and channels in this part of the cave, until the vats were well filled. Two wooden pipes, made from the slender trunks of trees, about the size of telegraph poles, extended from the mouth of the cave to these vats. Through one of these pipes the water was conveyed from the entrance of the cavern into the leaching vats.

In filtering through the nitrous earth in the vats the water became laden with saltpeter in solution. This was collected and conveyed back to the mouth of the cave through the other wooden pipe, where it underwent a crude process of distillation and refining, whereby the saltpeter crystals were obtained. So rich was the earth in niter that one full vat would produce more than a thousand pounds of saltpeter. When the earth had been leached it was taken from the vats and thrown in great hills and heaps throughout this region of the cavern. In passing through this part of the cave the tourist is compelled to wind among these mounds and hillocks of leached earth, frequently climbing

over them. Their great number, size and extent testify to the enormous amount of saltpeter produced here while the works were in operation.

TEMPERATURE

The natural temperature of the cave, as ascertained by numerous and careful observations and tests, is fifty-four degrees Fahrenheit. This temperature is not effected by extremes of external heat or cold, but is maintained throughout the year. This indicates that the earth's crust has a temperature of fifty-four degrees at this latitude.

There is always a strong outward current of air at the mouth of the cave during the summer months, and a corresponding inward current during the winter months. These currents are caused by the unequal temperature of air in the cave and the external air, the current always going from the colder to the warmer region. It is the same cause that gives us the sea breeze and land breeze on the sea-coast, and the equa-

torial winds of the torrid zone. In this way the cave breathes, taking a long inspiration during the winter months, and a long expiration during the summer months.

PITS AND DOMES

The cave has five levels or tiers, that have been formed in past geologic ages, and in traversing its avenues the tourist passes through and along portions of each of these stories or tiers. It frequently occurs that the floor of one avenue is the ceiling of another directly under it. In many places the rock substance between the different tiers has fallen through, and thus the avenues of different levels have been connected by immense openings. These openings sometimes extend through two or three tiers of the cave, and have an immense height and depth. At Gorin's Dome and the Bottomless Pit the vertical walls of these openings extend from the highest to the lowest levels of the cave, and give a complete vertical view of this mighty underground world. Such openings are called

pits when viewed from above, and domes when viewed from below.

LOOPS

At many places in the cave the passage will lead down a hill or incline and, making a bold curve, pass directly under the avenue that has just been explored. This feature exists at the Corkscrew, Dante's Gateway and Napoleon's Dome. In passing the avenue that leads directly over Napoleon's Dome the peculiar sound of our falling footsteps reveals the fact that only a very thin shell of rock separates us from the great cavity below, and we feel somewhat inclined to tread lightly while passing over the place.

ENTRANCE

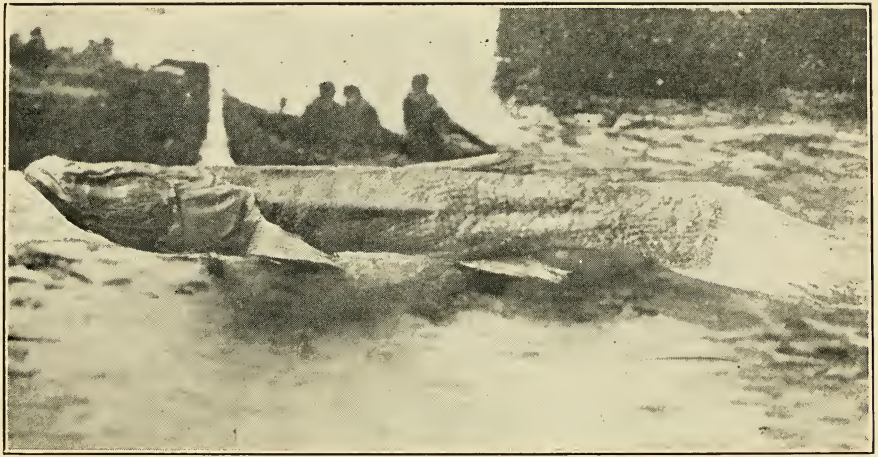
The Mammoth Cave has but one entrance, or if there is any other the fact has never been known; and the visitor today passes in at the same opening through which Hutchins and his famous bear crawled a century ago. At a distance of about fifty yards within the cave the walls converge and the ceiling descends until the

passage is rather small. At this place is swung a massive iron gate, always secured by lock and key, to protect the beauties and wonders of the interior from the depredations of vandals.

Inward to this gate anyone may go at any time without paying a fee, but beyond this no one is allowed to pass except those who have purchased cave tickets and are accompanied by a guide.

ANIMAL LIFE

Animal life is not very abundant in the great cavern, and vegetable life is almost entirely wanting. Near the entrance to the cave, and among the remains of the old saltpeter works, are a few cave rats, which were well known by the early miners. During the winter myriads of bats may be found clinging to the ceiling and walls of some of the chambers and avenues not far from the mouth of the cave, but these "cave bats" are only the ordinary little brown bats of this latitude, and other kindred varieties, which enter the cavern merely to pass the long, cold



BLIND FISH--ECHO RIVER

months of winter. At a few places along the "River Route" are found specimens of a small, light-brown beetle; and in other places along the same route, where old timbers from bridges have been thrown, are seen a few white myriapods. In some of the chambers of the cave are innumerable "cave crickets." These bear but little resemblance to the ordinary cricket, being almost perfectly white, and having very long, slender legs and small bodies.

BLIND FISH

By far the most interesting animal of the vast cavern is the wonderful blind fish—Amblyopsis spelæus—of Echo river and adjoining waters. This little fish, only three or four inches in length at maturity, is almost perfectly white, has not the least vestige of eyes, and is without scales. It has dorsal, ventral and pectoral fins well developed, and the tail is a single lobe. The head and mouth are rather wide, and its form is very similar to that of the cat-fish. In the same waters with the blind fish are found

the white cray-fish, two or three inches long, also blind, as eyes would be useless organs in such dense blackness as reigns in the great depths of these subterranean channels.

VEGETABLE LIFE

The conditions within the cave are less favorable for vegetable growth than for animal growth. In none of the drier avenues is there sufficient moisture to sustain extensive plant growth; besides, the temperature is too low for most vegetation. In some of the lower levels of the cave may be found small quantities of vegetable matter, all of a fungus nature. Near the landings along Echo River are a few small toadstools, all of them perfectly white. Along Audubon Avenue are numbers of small mushrooms, growing in clusters. This fact led to the erection of extensive and costly mushroom beds at this place with the hope of producing large quantities for market, but as conditions for vegetable growth are unfavorable in the cave, the enterprise proved a failure.

OWNERSHIP

The ownership of the cave since its discovery in 1809 has been as follows: McLean bought it in 1811, Gatewood in 1812, Moore in 1816, Gatewood again soon after, Gorin in 1837, John Croghan, a physician of Louisville, in 1839. Dr. Croghan died ten years later, and by a will, which is now on record in Louisville, he left the estate, consisting of the cave and some two thousand acres of land about its mouth, to his nine nephews and nieces. Those heirs were the children of Maj. Gen. Thomas S. Jessup, who was for forty-two years quartermaster general of the U. S. Army, and of Col. George Croghan, known as the "Hero of Sundusky."

Of the original life-tenants, five are now (1909) living, four of them the daughters of Gen. Jessup, and one daughter of Col. Croghan. The daughters of Gen. Jessup are: Mrs. Sitgreaves, living near Boston; Mrs. Blair and Mrs. Niderlson, living in Washington, D. C., and Miss Jessup, living in Europe. The living

daughter of Col. Croghan is Mrs. Rogers, living in California. The will provides that these life-tenants are to share the income equally until the death of the last of them, when the estate is to be sold at public auction and the proceeds divided equally among their heirs.

MANAGEMENT

The management of the cave is now in the hands of Albert C. Janin, of Washington, D. C., who is trustee of the Mammoth Cave estate, and who has had charge of it for a number of years. The estate consists of all the appliances and privileges within the cavern, about two thousand acres of land under which the principal avenues of the cave pass, and the large hotel near the entrance. When asked if there was a probability that the estate of the Mammoth Cave would some day become the property of the state of Kentucky, Mr. Janin replied, "No; we consider it a nice thing to have in the family."

THE HOTEL

The first room of the hotel was only an or-

dinary log cabin, and was erected a century ago and used by the early miners and proprietors of the saltpeter works. This room is still standing and is in constant use, but the walls have been covered on the outside with siding and on the inside with ceiling, and as it is kept well painted, the building today has but little of its former appearance.

Back from this original room, toward the south, for a distance of five or six hundred feet, are other rooms, erected at later dates as they were needed, all of them one story in height. These rooms are all connected, and along the entire distance extends a very wide porch or portico, fronting to the east. Although not very inviting in their outward appearance, these rooms are well furnished within and afford pleasant accommodations.

In front of the original room has been erected a very large frame building with an immense two-story porch or portico in front. This porch is about twenty feet wide and sixty or

more feet long, and from its upper floor we get a most delightful and picturesque view of the beautiful hotel lawn and other rustic scenes.

DINING ROOM

The dining room of the hotel is especially striking in its appearance. It contains two rows of long dining tables, and will seat about two hundred guests. The ceiling is rather low for so large a room, and passing through the entire length of the ceiling overhead is an immense cross-beam, supported by massive columns. The windows are extremely old style, the sash being very large and filled with panes of glass not more than twelve by fourteen inches in size. The sashes are not swung by weights, and when raised are held up by wooden latches or supports at the side. This old colonial style of architecture gives the room a very primitive appearance, and is especially enjoyed by visitors who seek a short relief from the environments of city life.

Directly over the dining room is a large assembly hall for the accommodation of guests.

The rooms are rather large and are furnished with from two to four beds each. As the hotel stands today it will accommodate three hundred and fifty guests, and the rates are two dollars per day. Dr. W. W. Ranshaw, of Covington, Ky., is the present proprietor.

CAVE ROUTES

In order to give tourists the opportunity of viewing as great a variety of scenery as possible the proprietors first established two principal routes, known as the "Long Route" and the "Short Route." The "Long Route" included the Crossing of the River Styx on the Natural Bridge and the boat ride on the famous Echo River, and was therefore frequently called the "River Route." The "Short Route" included the passing of many deep pits, gorges and domes, and on that account was sometimes called the "Pits and Domes Route."

Owing partly to important discoveries recently made, and partly to the great extent of the Mammoth Cave, the designations of "Long

Route'' and ''Short Route'' have been abolished, and trips in the cave at present are subdivided into four different routes, as follows:

1. Echo River, Pits and Domes Route.
2. Star Chamber, Gothic Avenue Route.
3. Main Cave and New Discovery Route.
4. Echo River, Cleveland Cabinet, Cathedral Domes Route.

The time required for making the different trips is about as follows:

Route No. 1, six hours.

Route No. 2, five hours.

Route No. 3, six hours.

Route No. 4, ten hours.

The cave rates are two dollars for any single route, and one dollar for each additional route.

EXTENT

The Mammoth Cave is so vast—all other known caves being mere cavelets in comparison—that even with this subdivision of the cave into four routes, only its most important features can be seen by the tourist. It is a great under-

ground world, full of interesting and awe-inspiring features. The scenery along the four principal routes is a constantly changing panorama, and is the most beautiful and sensational in the entire cavern. It is wonderful, marvelous! Even the use of superlatives gives only a faint idea of its grandeur and its beauty.

FORMATIONS

Stalactites and stalagmites—words so meaningless and hard to remember when first learned in geography and geology—here take on the forms of fluted columns, pendant cones, festoons and draperies, and other wall and ceiling decorations that would be the envy of the most skillful stucco worker. Within the avenues of the cave are great auditoriums with lofty ceilings; domes hundreds of feet high, the sides formed of tier upon tier of ornamented columns, balanced rocks and hanging rocks; huge piles of loose rocks that seemingly have been swirled round and round by surging underground waters until they have worn great caverns; mighty clefts and

crevices as if made by violent earthquakes.

RECREATION

To the observant visitor a stay at the Mammoth Cave is rich in pleasure, relaxation, new experience and lasting impressions. True, there are many people who visit the great cavern and never realize its grandeur or beauty. They go through the cave much as they would through the Coney Island attractions. They would modernize every thing in the region, put elevators in the cave, install electric cars, electric lights, lunch stands and moving picture shows. They are the visitors who go a-touring to seek something new and different from the ordinary, and then complain because they find it. A stay at the cave also means improved health. The primeval forests, the altitude, the pure, bracing air, and the exercise in the open all tend to tone up one's system almost immediately. All the glowing terms that are used to describe and exploit health resorts in other places may be used truthfully of the Mammoth Cave.

PRESERVATION

It has been the aim of the proprietors to preserve the cave in all its beauties and wonders as an original work of nature. In this they have succeeded so well that many of the older inhabitants claim that the impressions left by a visit to the cave today are paralleled by those left when they visited the cave three-fourths of a century ago. Only that change has occurred which would naturally result from a more thorough acquaintance with the wonders within. The remains of the old saltpeter works, the bridges over the gorges and pits, the stairways leading up impassable cliffs, the iron guard-rails along places of danger, and the state temples and monuments are the only evidences of the work of man. All else is as it came from the hands of nature.

VISITORS

The average number of annual visitors to the cave, as shown by the registers, is about fourteen thousand. As most visitors buy at least

two tickets, and many of them four, the income from the sale of tickets alone is approximately fifty thousand dollars. Besides the income from the sale of tickets, is that from the hotel itself, and from cave specimens and souvenirs which are kept on sale in the offices of the hotel at all times. The total annual income from all sources is perhaps not less than one hundred thousand dollars.

SAFETY

The journeys through the various routes and avenues of the cave are all perfectly safe. The boats on Echo River are well built, the guides are all expert oarsmen, are thoroughly competent and reliable in every way, and know every nook and corner of the cave perfectly. Each tourist carries a small cave lantern, and the dangerous pits, gorges and chasms are well guarded with heavy gas-pipe railing. So far as is known, no life has ever been lost within the cave, although a few accidents have occurred. The regular guides in attendance at the cave at

present are: Edward Bishop, whose grandfather first crossed the Bottomless Pit in 1840 and explored the cave beyond the pit; William Bransford, Joshua Wilson, Robert Lively and Matt Bransford. Besides the regular guides, there are several extra guides always present to assist in cases of emergency. Some of the regular guides have been in constant attendance for more than twenty years.

CHAPTER II.

DESCRIPTIVE

ROUTES ONE AND TWO COMBINED

ON Monday morning, July 6, 1908, the writer left Johnston City, Ill., for a visit to the famous Mammoth Cave of Kentucky. After a delightful ride of some three hundred miles over the L. & N. from Mt. Vernon, Ill., we reached our destination early Tuesday morning. As soon as we had taken breakfast we purchased a cave ticket, donned a cave suit and were soon off for the entrance to the cave. Our party consisted of Robert McDale of New York City; Frank H. Feldkamp of Cincinnati; Edward E. Byland of Paris; William R. Webb of Bowling Green, Ky.; Florence Edwards of San Francisco; Ellen Raymond of Topeka, Kan.; Myrtie Luther of New Orleans; Ethel Ruby of Nashville, Tenn.; Mr. and Mrs. J. M. Ramsey of

Ready to enter the Cave—Writer second from left, top row.

OPENING TO CAVE—LOOKING OUT.

Bowling Green, Ky.; Henry Chandler, of Boston, Mass., and the writer.

NATURAL BEAUTY

The natural scenery from the hotel to the mouth of the cave is very beautiful and cannot fail to awaken interest to those who love the sublime in nature. The pathway that leads down the hill-side from the hotel to the mouth of the great cavern is clustered with tulip trees clothed in the richest of foliage; with immense oaks from whose lofty boughs hang beautiful festoons of vines; with giant poplars, chestnuts, sycamores, spice-wood, and a beautiful undergrowth of bushes, shrubs, ferns and mosses.

THE OPENING

The opening to the cave is an immense funnel-shaped vestibule of limestone ledges, and from the mid-arch of the entrance, fifty feet above, leaps a beautiful little waterfall. This miniature cascade gleams and sparkles in the sunlight in its descent to the rocky floor beneath, and after flowing only a few feet it suddenly

sinks and is again in absolute darkness. Through some unknown subterranean channel these waters emerge again and join with the waters of Green River beyond.

What a striking emblem of human life is this glittering little stream! Like our bodies it emerges from the darkness of earth, passes a brief life in the light, and returns again to earth. As its waters, after sinking, come again to light and exist beyond, so will our lives find a way to the realm of eternity beyond, and live again.

SUBTERRANEAN SYMPHONY

As we pass this little cataract at the foot of a stone stairway we hear its echoes reflected over and over again from the walls, roof and crevices of the mighty limestone entrance, and this gives us the first realization of subterranean symphony. This symphony is unlike any of the sounds heard in the outside world. It is peculiar to subterranean channels and galleries, and is heard at many falling brooks, springs and cascades within the cave.

A LOOK BACKWARD

After passing a short distance into the mouth of the cave we cast a look backward to get another glimpse of the beautiful blue sky and sunlight before plunging into absolute blackness. As we were taking this last look backward the current of air, which is always present at this place, wafted to and fro the beautiful festoons of mosses and maiden-hair ferns which fringe the opening, and these, with the gently moving forest foliage, seemed to be wafting and nodding us a last farewell. One of our party on seeing this, waved her hand in response, and with some emotion exclaimed, "Good-bye, sweet sunshine, green leaves, and blue sky! I may never return to you alive!"

GREAT IRON GATE

We have now reached the great Iron Gate, and when the guide unlocks it we are soon on the inside of the real cave. When the gate is again locked we realize that we are shut off from the world of light above. The guide in-

formed us that an occasional timid person has here turned back, but none of our party had this timidity, and we obeyed the orders of our guide and entered darkness to seek the mysteries and wonders beyond.

HUTCHINS' NARROWS

Immediately after passing the gate we found the roof very low for a short distance, but we soon emerged into Hutchins' Narrows. Nearly a century ago the miners piled the loose rocks on either side to give a better path through which to carry their burdens, and this left a narrow passage only a few feet wide, called Hutchins' Narrows. The wooden pipes, which they used for carrying the water from the little cataract at the entrance of the cave to the leaching vats, are still in their places and in a good state of preservation. About midway of the Narrows, on the left, our guide pointed out the graves of two Indians whose bodies were found by the first miners and buried at this place.

THE GREAT ROTUNDA

Just beyond the Narrows we descended a small hill and suddenly emerged into an immense hall formed by the junction of two large avenues. The grand arch which forms the roof of this great chamber is more than sixty feet high, and is composed of a whitish limestone, unsupported by pillars or columns, and is folded into fantastic figures and forms of great beauty. This immense hall is very appropriately called the Rotunda, and the guide informed us that we were directly under the dining room of the hotel at which we had taken our meals a half hour before. Here are to be seen the first leaching vats used by the early miners in making saltpeter in 1812-1814. Late in the fall millions of bats enter this room to take the long sleep of winter, and remain suspended in great clumps and clusters from the walls and angles for five months.

RAFINESQUE HALL

Leading from the Rotunda are two avenues, one of them the main cave and the other one

Audubon Avenue. The first chamber of special interest along Audubon Avenue is Rafinesque Hall. This hall was formed by the falling of an immense mass of stone from the roof, and this heap of stone is pointed out by the guide as Lookout Mountain. While our party rested for awhile at the foot of this mountain, the writer, accompanied by another of our party, climbed to its summit, and from the roof above saw the falling waters of a beautiful little spring. Around the waters of this we found a few blind beetles of rather small size and almost perfectly white.

VESPERTILLIO HALL

We next entered a beautiful hall in the roof of which nature has sculptured a large inverted kettle. This hall is the winter home of myriads of little brown bats, and is on that account called Vespertillio Hall. From this hall we pass through avenues studded above with countless stalactites usually of small size, mimicing the form of almost every familiar object. So perfect are many of these formations that they appear to have

come from the hand of a skilled artist. And so they have, from nature, the most skilled of all artists.

THE LONE SENTINEL

We then ascended a small hill, and after passing between walls whose rocks seemed to be cemented together with calcium, we approached one of the most beautiful and extensive stalactites in the cave. This immense formation has joined the stalagmite below, and the column thus formed appears to serve as a support for the great stone roof above. This lone stalactite is fluted, folded, corrugated and carved into myriads of beautiful forms. Our guide called it the Lone Sentinel, and told us that it was a standing guard at the entrance to Olive's Bower.

OLIVE'S BOWER

Beyond the Lone Sentinel, hanging from the center of the roof, is a beautiful, perfectly formed, cone-like stalactite of immense size. This formation is of a whitish color, and is surrounded by numberless others of the same form,

but smaller in size. Down the sides of these pendant, alabaster cones, unceasingly trickle little drops of water, laden with building material taken from the limestone above. Each drop adds its mite of mineral deposit to the lower extremity before falling to the floor beneath, and in this way the stalactites slowly grow downward.

As we stood around this majestic canopy we could see the tiny drops of water glisten for a moment as they clung to the lower tips before falling. These reflected the light from our lanterns and gave back brilliant hues like sparkling gems of rubies and diamonds. On the floor beneath are large masses of the same substance, formed by the falling drops of water, and these are rising slowly through the ages to meet those above. This immense cluster of stalactites and stalagmites, known as Olive's Bower, is one of the most beautiful scenes in the cave, and it terminates the subterranean journey in this direction, as the avenue closes just beyond.

PIGEON BOXES

Returning again to the Rotunda we are guided along the main avenue of the cave for a short distance to formations in the wall at our left closely resembling openings in a dove cot, and for this reason they have been named the Pigeon Boxes. This peculiar formation was undoubtedly made by the unequal solution of rock substance in the walls. Other formations of a similar character are found at various places in the cave.

METHODIST CHURCH

The next point of special interest beyond the Pigeon Boxes is the Methodist Church. This beautiful and spacious hall is formed by the junction of Archibald Avenue with the main cave. It was so named because in the days of the early miners it was frequently used for the purpose of holding religious services. Occasionally when the party includes a clergyman, religious services are still held. On a recent occasion when religious services were being held one

of the party was called on to lead in prayer. This he eagerly did, and the guide informed us that most of the prayer was devoted to asking the Lord to forgive them for their folly in entering such a dangerous and gloomy dungeon, and imploring Him to deliver the entire party, guide and all, from the cave unharmed.

BOOTH'S AMPHITHEATER

At a point a little farther on we entered a magnificent chamber which is formed by a junction of Gothic Avenue with the main cave. Here we climbed a broad flight of stairs and entered an apartment somewhat in the form of an amphitheater. At this place, in 1876, the celebrated actor, Edwin Booth, rendered Shakespeare's "Hamlet" to a large audience, and found the acoustic properties of the chamber to be almost perfect. Since that time this imposing chamber has been called Booth's Amphitheater. We could not help longing to hold a high school commencement in this beautiful amphitheater, and reflected that such subjects as "There is a

God," "Wonders of Nature," "Creative Power and Wisdom," "Subterranean Explorations," "Cave Dwellers" would be very appropriate themes for orations.

MONUMENTS AND TEMPLES

The main features of interest in Gothic Avenue besides the numerous stalactites, are the state monuments and temples. These structures are erected from the loose stones so abundant in this part of the cave, each visitor being allowed to select a stone and place it on the temple of the order to which he belongs, and one on the monument of his native or adopted state. The writer took much pleasure in selecting four of the most beautiful stones and placing one on the Masonic Temple, one on the Odd Fellows Temple, and one each on the Tennessee and Illinois Monuments.

REGISTER HALL

On the ceiling and walls throughout this section of Gothic Avenue, among the Temples and State Monuments, are to be seen the names

of thousands of tourists. These names and dates have usually been recorded by smoking them on the walls and ceiling with burning candles or torches, but in many cases they have been carved into the flinty limestone walls with jack-knives. Doubtless the tourists who thus record their names are moved by the same impulse that causes the school boy to carve his name in bold letters on the top of his desk.

NAME CARVING

While one of our party was thus engaged in recording her name on the limestone wall, our guide harangued her about as follows: "The names on these walls have been recorded by only two classes of persons. One class is composed of persons whose chief desire is to assume a new name, and they think that by leaving their original name in the cave they may have a better opportunity of finding some one who will give them a new name. The other class is composed of persons whose deeds through life have been so insignificant that they will soon be forgotten,

and they resort to this act of vandalism as the only means of transmitting their names to future generations." Our friend stopped her name carving immediately, but did not tell us to which class she belonged.

POST OAK PILLAR

The first great stalactitic column beyond the temples and monuments is the Post Oak Pillar. This immense formation closely resembles the trunk of an old oak whose bark has fallen off, hence its name. Suspended from the roof around this imposing pillar hang numerous other formations of small size, resembling such objects as birds' nests, icicles and clusters of grapes. In close proximity are numerous other great stalactites and columns of exquisite beauty and form. Among these are Gothic Chapel, Pillared Castle, Pillar of Hercules, Hornets' Nests, Elephants' Heads, Pompey and Cæsar, and the beautiful Jenny Lind Armchair. The material of which these formations are composed is much like onyx stone, and is sufficiently transparent to admit

the rays of light from the lanterns carried by the tourists.

PILLAR OF HERCULES

The Pillar of Hercules is remarkable for its peculiar formation and immense size, being one of the most extensive formations of the kind within the cave. It is not a solid column like the Lone Sentinel or Post Oak Pillar, but is composed of a clustered group of stalactites and stalagmites which have united together in such a way as to resemble immense frozen cascades sometimes seen about waterfalls during the winter months. The great size of this matted cluster of pillars is suggestive of the name.

JENNY LIND ARMCHAIR

The beautiful Jenny Lind Armchair was formed by the union of an irregular stalactitic mass above with a similar stalagmitic mass below, making a solid column from floor to ceiling, and in form somewhat resembling a massive armchair. This was originally called Wilkins' Armchair, but when Jenny Lind was touring the

United States under the management of P. T. Barnum in the 50s, she visited the Mammoth Cave and rested for awhile in this chair, and since that time it has been called Jenny Lind's Armchair. Each of our party rested for a moment in this chair, not so much because we were tired, but because it had been occupied by the sweet Swedish singer more than half a century before.

THE BRIDAL ALTAR

The last object of special interest in Gothic Avenue is the Bridal Altar. Hanging from the middle of the roof above is an immense mass of stalactitic formations, whitish in color, and projecting downward from this cluster are three columns of the same material, very large above but decreasing in size to the floor beneath. These pillars are arranged in triangular form and enclose a small chamber between them. Under the bower of this wonderfully formed canopy have occurred fifteen weddings. The guide explained to us that the pillar standing somewhat

apart from the other two represents the clergyman who officiates at the weddings, while the other two standing closer together represent the bride and bride-groom. Beyond the Bridal Altar we approached a hill that has been formed by the falling of an immense mass of stone from the roof above, and as this hill closes the avenue in this direction it has been named Limitation Hill.

LOVERS LEAP.

By a narrow, crooked pathway we next descended a steep, rugged hill, called the Hill of Difficulty, to the face of a cliff fifty feet below. Looking backward and upward we saw, projecting over our heads and from the wall above, a long, slender rock, known as Lovers Leap. While we rested here for awhile our guide returned to the crest of the cliff above, and, with lantern in hand, climbed onto this projecting monolith, and walked out to its very extremity as though he intended to make the fatal leap. While standing there on its tip, fifty feet above our heads, he spoke in deep, clear tones and

said, "If any of you have become despondent over a love affair and wish to use this rock for the purpose indicated by its name, you now have the privilege of doing so."

JOSEPH'S PIT

From the foot of this hill we entered a narrow opening in the face of the cliff, called Elbow Crevice. Through the folded, fluted and wrinkled walls of this narrow crevice we crowded until we reached a dark and ragged opening, which the guide told us was Joseph's Pit. This name recalled to our mind the bible story of Egyptian bondage and deliverance.

NAPOLEON'S DOME

Our course then turned to the left and we soon entered a large hall or avenue, three-fourths of a mile in length, and were soon at the base of Napoleon's Dome. This is one of the most awe-inspiring domes in the great cavern, and is said to closely resemble the final resting place of the great Napoleon. From the very apex of the dome above a massive block of limestone has

fallen, called by the guide Gatewood's Dining Table.

GOOD TEMPLARS MONUMENT

At this point we were directly under the Elephants' Heads of Gothic Avenue, and had just passed under the Bridal Altar. A short distance beyond this dome is a small pool of perfectly clear water called Lake Purity. Near the brink of this little lake the Good Templars have erected a beautiful temple to their order, a very fitting place for such a monument. Just beyond Lake Purity, on the left, is a great mass of rough limestone concretions and stalagmitic material, cemented together by carbonate of lime, and is known as the Cinder Bed, or Devil's Ash Pile.

ANNETTE'S DOME

After passing for a long distance through winding avenues with floors of rough, broken rocks, we could hear the faint sound of falling water. We then passed down a rugged cliff and soon reached the low entrance to Annette's

Dome. This is a very high and picturesque dome, and gives a good view of the work and effect of falling water. The walls are corrugated, fluted and folded into imposing forms as if they had been fashioned by the hand of a great sculptor. Leaping from an opening in the side of the wall some thirty feet above comes Shaler's Brook. The symphony produced by the unceasing clatter of this little brook is somewhat akin to that heard at the foot of the little cataract at the mouth of the cave. These waters break into spray in their descent and, collecting at the bottom, form a little stream which flows quietly across the rocky floor of the dome and soon passes from view under the mighty limestone ledges.

LEE'S CISTERN

After we have descended another difficult hill and have crowded ourselves through small and ragged avenues, part of the way on bended knees, we again hear the sound of falling waters, and squeezing through a small crevice we find

ourselves near the brink of a large dome, the sides of which can not be seen, and the bottom of which is filled with water. This reservoir is called Lee's Cistern, and receives the waters of Shaler's Brook after they have made a wild leap of nearly one hundred feet. The avenue here closes and ends the journey in this direction.

SENSATIONAL EXPERIENCE

Retracing our journey through Gratz Avenue we soon reach the Hill of Difficulty again which we ascend into Gothic Avenue and are soon in the region of the Hornets' Nests and Elephants' Heads, which we had viewed an hour before. At this point we are directly over the crest of Napoleon's Dome, and only a very thin shell of rock separates us from the great depths below. Here our guide placed his feet, somewhat apart, firmly on the thin shell-rock floor, and, inflating his lungs to their utmost capacity, uttered a deep sonorous undertone of stentorian volume. The vibrations of his voice were caught

up by the thin floor on which we stood and were transmitted to the immense cavity of the dome beneath, which, acting as a gigantic resonance box, sent back the tone attuned and augmented a thousand fold. So intense was this resonance that the very floor on which we stood was felt to tremble violently as the vibrations reached their greatest intensity. This immense volume of sound could be heard to roll along unknown and unexplored avenues and channels until they gradually faded away and were lost in the untrodden gulches and depths below. This is one of the unique experiences in the mighty cavern.

THE STANDING ROCKS

We returned to the main channel of the cave through Gothic Avenue, passing again the Jenny Lind Armchair and Bridal Altar, and were soon at the Standing Rocks. These immense rocks have been detached from the ceiling above, and in falling they struck on their edges, and remain in that position, hence their name. These are the largest rocks, except Gatewood's Dining

Table, that have ever fallen from the ceiling. As these rocks are very hard and solid, and without seam or fissure of any kind, it is hardly possible that they were detached by their own weight, but must have been literally torn from their fastening by some violent internal force.

MARTHA WASHINGTON STATUE

The next feature of interest is an illusion, and is known as the Martha Washington Statue. This mimic statue is formed when a brilliantly illuminated wall is interfered with by two intervening walls in such a way as to give the correct outlines of the statue on the face of the lighted wall. This deception is almost perfect, and the resemblance of the illuminated part of the wall to the statue of Martha Washington is very striking. The discovery of this illusion was an accident, and was made when two exploring parties had just passed each other in this part of the cave. The guide with one of the parties was illuminating a large chamber with a torch, and upon looking back in that direction the other

parties discovered the brilliant profile of the statue.

SECOND SERIES OF LEACHING VATS

Near the Martha Washington Statue are to be seen the second series of leaching vats used by the early miners. These, like the ones at the Rotunda near the entrance to the cave, are in a good state of preservation. The wooden pipes that conveyed the water from the waterfall at the mouth of the cave to the vats and back again after the leaching process, are supported on crude pillars of rough stone just as the miners left them almost one hundred years ago. One of these is so placed that visitors may test its weight by lifting it from its supports, and when we lifted it we were amazed at its extreme lightness.

Along the wide avenues in this region of the cave, where the ox carts were used to haul the leached earth and saltpeter dirt a century ago, are to be seen the tracks made by the oxen as they plodded their weary way with the heavy

loads of material. The ruts worn by the cart wheels, some of them almost hub deep, are as distinct today as though they had been made only a short time.

GIANT'S COFFIN

On our right and close to the wall is one of the largest single rocks in the cave. Its shape is exactly like that of a large burial casket, and it is called the Giant's Coffin. This immense stone measures forty-five feet in length, from twelve to fifteen feet in width, and eighteen feet in height, and is estimated to weigh more than two thousand tons. This gruesome looking object has been detached from the wall above, and in falling it assumed a horizontal position as though it had been placed there by the hands of an undertaker. The place that it once occupied in the wall is very distinctly seen, and it was doubtless torn from its bed by the same internal force that brought down the Standing Rocks, as these are in the same region of the cave.

GIANT ANT-EATER

Along this avenue of the cave are seen many very accurate and striking color formations. These imitation pictures have been formed by water, laden with dark mineral matter in solution, filtering down from the regions above, and staining the light-colored walls and ceiling. One of these represents a Giant Ant-eater resting on the fallen trunk of an old tree, and is seen on the ceiling overhead near the Giant's Coffin. This mimic picture is strikingly accurate, and is easily recognized by those who have seen either the animal, or its picture in natural history.

GIANT AND GIANTESS

Another very fine color imitation is the Giant and Giantess. This represents the Giant in the attitude of having just hurled an infant from his arms, which appears to be passing through space toward the Giantess, some twenty feet away, while the Giantess herself is in the attitude of catching the babe in her arms when it reaches her. This imitation picture is almost as

perfect as though it had been designed by the brain of a great artist and penciled by his skillful hand.

THE ACUTE ANGLE

A short distance beyond the Giant's Coffin the avenue turns suddenly to the left, and forms what is called the Acute Angle. This is a very sharp angle, being not more than sixty-five degrees, and from the vertex in both directions extend immense halls of great beauty. This is one of the sharpest turns found in any avenue of the cave, and reveals the fact that underground streams--which surely formed all the avenues of this mighty cavern--are subject to the same laws and conditions in their courses as are the surface streams. The most imposing scene at this point is the great stone column that forms the vertex of the angle. This is so regular and symmetrical that it appears to have been turned on some gigantic lathe, the beads and grooves being sufficiently large to offer safe footing for those who wish to walk upon them.

THE STONE COTTAGES

In the broad avenue a little farther on stand the two Stone Cottages that were built in 1843 for the homes of consumptives. Each contains a single room, some twelve or fourteen feet square, and the walls are about eight feet high, and without roof or cover of any kind. The stone of which they are built is a gray limestone, not very evenly dressed, and was obtained from the loose rocks so abundant throughout this region of the cave.

These abandoned cottages stand only a short distance apart, and present a sad and lonesome appearance. The writer entered one of them with lantern in hand, and upon examination found the floor and door casings to show no signs of decay after having stood there for two-thirds of a century. On the outside of the first cottage, and near the wall, stands a wooden saw-rack, also in a good state of preservation, and which the poor invalids used in sawing wood as a means of exercise.

HOMES FOR CONSUMPTIVES

The fact that the atmosphere in the cave is almost absolutely pure, and that vegetable and other organic matter decays so slowly, led to the erection of these cottages with the hope that conditions in the cave would prove beneficial to those poor unfortunates who were afflicted with the dread disease. Soon a dozen or more upon whom the malady had fastened itself were carried to these cottages with the hope of finding permanent relief.

For a short time the pure atmosphere in the cave appeared to improve their condition, but as they were removed from the influence of the sunshine—the most essential thing in such a disease— they soon began to grow weaker, and in a few months they were all dead. Their bodies were laid to rest in a little plot of ground not far from the mouth of the cave, and the small stone tablets still tell their names and the dates of their passing away. Since their deaths these cottages have stood as silent memorials to them.

THE GREAT STAR CHAMBER

After passing the Stone Cottages we soon approach the crowning scene of this avenue. The walls widen, the ceiling seems to have ascended beyond the reach of the eyes, and we gaze upward into impenetrable darkness. Then our guide informs us that we are in the famous Star Chamber, and tells us that if we will obey his instructions he will show us a beautiful blue sky, decked with myriads of twinkling stars. All our lamps are removed and we are left in absolute darkness. Our guide instructed us to remain perfectly still and silent and look upward for the appearance of stars in the sky. This intense darkness, with the deathly silence of our party, soon became oppressive, and we then, for the first time in life, realized the full meaning of absolute blackness and darkness.

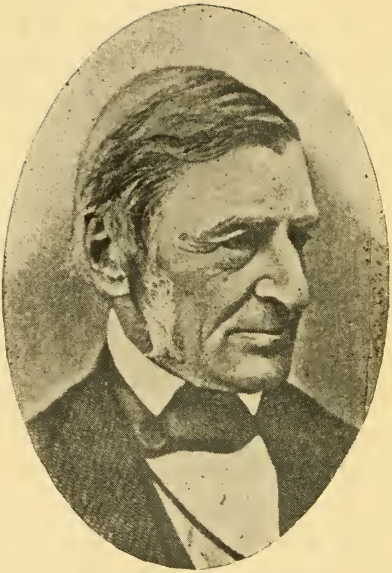
A WONDERFUL ILLUSION

While we are thus gazing upward into this impenetrable gloom of blackness, a faint gleam of light breaks on our vision above. This soft

light gradually becomes a little brighter, and soon reveals to us the appearance of a real sky, as though we were looking upward at the blue dome of heaven. Then the twinkling stars come out one by one, and in a short time the mimic sky is decked with brilliant constellations, the milky way appears, and a comet flashes across the celestial dome. As we are intently beholding this beautiful and sublime scene, suddenly we hear a low muttering as of distant and subdued thunder, and in the distance see the dense folds of a cloud approaching us. This mimic cloud rolls itself out towards us like a banner unfurled to the breeze, and in a short time the sky is overcast, the stars are blotted out, and we are left again in utter darkness. The illusion is so perfect that exclamations of wonder and admiration break from the lips of all our party, notwithstanding the instructions of our guide to remain silent.

PRODUCING THE ILLUSION

This wonderful illusion is produced in the



RALPH WALDO EMERSON

following manner: The blue limestone in the ceiling of this great chamber is pierced by innumerable formations of white gypsum which always glistens when light is thrown upon it. Some of these formations are small, some large, some single, and some in clusters. After our guide had left us in darkness he entered some secluded corner or crevice of the avenue, from which the light of his lantern could be thrown on the ceiling above us. This light is just sufficient to give the limestone ceiling the appearance of a blue sky, and to cause the white gypsum formations to send back glistening rays as though they were shining stars and constellations.

EMERSON'S VISIT

Emerson's essay on "Illusions" was written after a personal visit to the Mammoth Cave, and in this essay he embodies the impressions left on him by the Star Chamber. In speaking of his visit he says:

"Some years ago, in company with an

agreeable party, I spent a long summer day in exploring the Mammoth Cave in Kentucky. We traversed, through spacious galleries affording a solid masonry foundation for the town and county overhead, the six or eight black miles from the mouth of the cavern to the innermost recess which tourists visit,—a niche or grotto made of one seamless stalactite, and called, I believe, Serena's Bower. I lost the light of one day. I saw high domes, and bottomless pits; heard the voices of unseen waterfalls; paddled three quarters of a mile in the deep Echo River, whose waters are peopled with the blind fish; crossed the streams "Lethe" and "Styx;" plied with music and guns the echoes in these alarming galleries; saw every form of stalactite and stalagmite in the sculptured, fretted chambers,—icicle, orange-flower, acanthus, grapes, and snowball. We shot Bengal lights into the vaults and groins of the sparry cathedrals, and examined all the masterpieces which the four combined engineers, water, limestone, gravita-

tion, and time could make in the dark.

"The mysteries and scenery of the cave had the same dignity that belongs to all natural objects, and which shames the fine things to which we foppishly compare them. I remarked, especially, the mimetic habit with which Nature, on new instruments, hums her old tunes, making night to mimic day, and chemistry to ape vegetation. But I then took notice, and still chiefly remember, that the best thing which the cave had to offer was an illusion.

"On arriving at what is called the 'Star Chamber,' our lamps were taken from us by the guide, and extinguished or put aside, and, on looking upwards, I saw, or seemed to see, the night heaven thick with stars, glimmering more or less brightly over our heads, and even what seemed a comet flaming among them. All the party were touched with astonishment and pleasure. Our musical friends sung with much feeling a pretty song,

"The stars are in the quiet sky." &c.,

and I sat down on the rocky floor to enjoy the serene picture. Some crystal specks in the black ceiling high overhead, reflecting the light of a half-hid lamp, yielded this magnificent effect.

"I own, I did not like the cave so well for eking out its sublimities with this theatrical trick. But I have had many experiences like it, before and since; and we must be content to be pleased without too curiously analyzing the occasions. Our conversation with Nature is not just what it seems."

PROCTOR'S ARCADE

Beyond the Star Chamber, for a distance of half a mile or more, extends Proctor's Arcade, a beautiful avenue filled with interesting scenery of various kinds, but is not usually visited by tourists in recent years. This ends our journey on the old "Route of Pits and Domes," and we here retrace our steps, follow our trusted guide, who leads us back into the presence of the sunlight that we had left seven hours before.

CHAPTER III.

DESCRIPTIVE

ROUTES THREE AND FOUR COMBINED

THE "River Route" includes a portion of the "Pits and Domes Route," and may be entered through Dante's Gateway just back of the Giant's Coffin, or by descending through the Corkscrew, a short distance beyond the Rotunda. Parties who tour the "River Route" usually enter through one of these passages and return through the other. Our party followed the guide along the "Pits and Domes Route" to the Giant's Coffin and, passing through a narrow space between the Coffin and walls of the avenue, entered the "River Route" through Dante's Gateway, reserving the passage of the Corkscrew for our return.

WOODEN BOWL ROOM

Soon after passing through Dante's Gateway

we emerged into Wooden Bowl Room. This is a very beautiful room, and in shape closely resembles a great wooden bowl. Our guide informed us that the early explorers of the cave found a small wooden bowl in this chamber, supposed to have been used by the Indians, and this also suggested the name.

THE BOTTOMLESS PIT

A short distance beyond the Wooden Bowl Room we approached one of the most sensational scenes in the entire cave—the Bottomless Pit. This fearful looking abyss is located in a gloomy corner of the great avenue, and extends directly across the tourists' pathway. This pit is now crossed by the Bridge of Sighs, a rather slender wooden structure, but perfectly safe. As we stood on the center of this bridge, directly over this yawning gulf of darkness, our guide threw a lighted torch down its black and ragged sides, which shone brightly for a long distance as it descended, but finally faded from our view in the unfathomable depths below.

SHELBY'S DOME

While we were looking downward into this mighty chasm of gloom and darkness, the guide called our attention to a scene directly overhead. Looking above us we beheld, by the light of a burning magnesium ribbon, Shelby's Dome, extending upward beyond the reach of the eye. This great dome is only an extension of the Bottomless Pit upwards, and was named in honor of Isaac Shelby, who served as first governor of Kentucky from 1792 to 1796, and again from 1812 to 1816.

BRIDGE OF SIGHS

To stand on the slender Bridge of Sighs and view the Bottomless Pit beneath, and Shelby's Dome above, is an experience of awe and wonder that can never be forgotten. Of all the names given to the various scenes in the cave, not one is more appropriate than Bottomless Pit. The sighs of relief expressed by our party as we reached the end of the bridge suggested that the name "Bridge of Sighs" is also very appropriate.

SCOTCHMAN'S TRAP

After passing the Bottomless Pit a short distance we entered a narrow, ragged avenue, and directly across our path, and only a few feet from the floor, was tilted an immense slab of limestone. This huge mass, in ages past, had fallen from the roof or walls above, and lodged in such a way as to be supported only by a very small and narrow projection, the only thing that keeps it from falling into the pathway below. We were compelled to stoop rather low while we passed under this massive stone, and we felt a sense of relief when we reached the open avenue beyond. This tilted rock is called the Scotchman's Trap, and was so named because a Scotchman was once touring the cave and on reaching this rock refused to go any farther, saying that it looked like a trap set to catch a Scotchman.

FAT MAN'S MISERY

Not far beyond the Scotchman's Trap we entered a narrow, tortuous, serpentine channel or crevice, known as Fat Man's Misery. This

channel is about two hundred and fifty feet in length, its walls are only about eighteen inches apart, and its direction changes many times. The space between the floor and the roof is less than five feet in many places, making it about as much misery to tall people as to fat ones. The walls of this narrow passage are very beautifully marked with waves and ripples, as if running water had suddenly turned to rock. From Fat Man's Misery we pass into a large open room, which our guide called Relief Room, surely a very appropriate name.

BACON CHAMBER

The next room is called Bacon Chamber, and is one of the best examples of natural mimicry in the whole cave. Hanging down from the ceiling above are masses of limestone shaped exactly like rows of shoulders, hams, and sides in a smokehouse. These mimic projections were formed by the unequal solution of the rock substance in the ceiling overhead, when water filled this avenue of the cave.

ODD FELLOWS HALL

A little farther on in this chamber are the Odd Fellows Links and the Atlantic Cable, both very striking representations, and of stalactitic formation. This part of the chamber is known as Odd Fellows Hall, and a temple, made from the loose rocks in this vicinity of the cave, has been erected at this place by members of the order.

THE DEAD SEA

In a few minutes after leaving Odd Fellows Hall, we find a large cliff of limestone, fifty or more feet high, to our left, and directly under its mighty shelves reposes a solitary pool of water, known as the Dead Sea. Just beyond, and on the opposite side, is a small waterfall about the same size as the one that leaps from the mid-arch of the limestone entrance to the cave, and our guide told us that it was thought to be a re-appearance of that subterranean stream.

THE NATURAL BRIDGE

Proceeding a short distance we found the

walls began to recede, and in a few minutes the guide informed us that we were on the center of the Natural Bridge. Looking downward, thirty feet below, we saw the black waters of the River Styx, a stream about forty feet wide, winding its way under the bridge. This bridge was formerly very dangerous, and our guide informed us that on one occasion Prof. Silliman, of Harvard, accidentally slipped from the crest of the bridge, and was barely saved by his guide, who caught him just in time to keep him from falling into the dark waters beneath. Since that time the place has been protected by a heavy iron guard-rail.

LAKE LETHE

Passing beyond the Natural Bridge, we entered a very large and beautiful hall, on the left of which is located the quiet body of water called Lake Lethe. This lake is three or four hundred feet long and forty or fifty feet wide, and in appearance very much resembles the River Styx, with whose waters it is supposed to be connected.

We crossed the lake near its narrowest point on a small pontoon bridge.

THE GREAT WALK

The avenue here is very wide, and its ceiling, which is almost one hundred feet high, is most beautifully flecked with variously colored and wrinkled limestone, giving it the appearance of real snow clouds in a wintry sky. Our guide here lighted some magnesium ribbon that we might see the effect in all its beauty and splendor. This broad avenue, covered with fine sand, is called the Great Walk, is about a quarter of a mile long, and leads directly to Echo River, the most interesting collection of water in the entire cave.

ECHO RIVER

Echo River varies in width from twenty to two hundred feet, and in depth from ten to forty feet, and its navigable length is about three-fourths of a mile. There are three arches in the limestone walls on the right, and the boats may be launched through either of them. When the

water is high it is impossible to pass under the first arch as it is only about three feet above low water. We did not enter through this arch, but went on to the second one which is much higher.

In going from the first to the second arch we passed through a place called the Sandy Desert, and just to our left was a dark, muddy, slimy region, which the guide pointed out to us as Purgatory. When we reached the second arch we were carried to one of the flatboats moored there; and after placing our lanterns in the center of the boat, and seating ourselves in equal numbers on each side, we were ready to begin our voyage of half a mile or more, at a distance of three hundred and sixty feet below the surface of the earth.

MARVELOUS ECHO

When our boat was fairly launched we were requested by our guide to remain quiet that we might witness the wonderful resonant qualities of the river tunnel. When all were silent

the guide uttered a deep, sonorous tone of great volume, keyed to the proper pitch to bring forth the responses from this mighty underground river tunnel. When he ceased, it appeared that the very water, the walls, the ceiling, and every nook and corner of the tunnel took up the tones and reverberated them from surface to ceiling, from wall to wall, from corner to crevice, until the whole limestone tunnel seemed to vibrate with the sweet resonance.

This continued for some time, and as the tones augmented they grew in melody and sweetness, and it seemed as if every gallery, avenue, and chamber in the mighty cavern had joined in the chorus. Finally the vibrations became a little weaker, the tones appeared to be a little softer, the volume was fading little by little, as the evening twilight softens into darkness, and thus the sound faded away so gently and imperceptibly that we scarcely knew when silence had returned. The effect of this thrilling experience is wonderfully touching and sublime.

CORNET ECHO

Our guide then took a silver cornet from a ledge of the river tunnel and blasted forth a succession of notes on the same key as those he had produced with his voice. As before, the same wonderful reverberation filled the river tunnel, but with tones still more melodious and enchanting. As these tones came back to us attuned and augmented a thousand fold, it seemed as though all the musicians of Sousa and Gilmore might have been assembled in a musical jubilee around the throne of Orpheus.

These musical notes died away as gradually as if they were coming from a receding band, and soon silence had again returned. I never before knew the full meaning and effect of echo, reverberation, and resonance. The impressions produced on one by this wonderful and unique experience can never fade from memory.

WELLINGTON'S GALLERIES

A short distance beyond where we landed could be heard the falling waters of a cascade,

and this chamber has been named Cascade Hall. A small avenue at the right leads to Roaring River, which is noted for its remarkable echo. We next entered Silliman's Avenue and found in it many places and objects of great interest. Far above the floor are large, shelf-like projections on each side, and these are called Wellington's Galleries. At the Dripping Springs we found buckets filled with the falling water, and from the clean tin cups that were hanging on the ledges of the walls we took a delicious draught of pure spring water.

SERPENT HALL

The next objects of interest in Silliman's Avenue are the Infernal Regions, Pluto's Dome, and Old Scratch Hall. In Serpent Hall are many winding grooves in the ceiling, which are very singular, and resemble closely the trails of crawling serpents. The guide informed us that this hall is completely filled with water when Echo River is at its highest point, hence these grooves are still forming in the ceiling during the

wet season at every overflow of the river.

GREAT WESTERN

We next descended a long, rugged hill, which our guide called the Hill of Fatigue, and saw at our left a great mass of limestone ledges, closely resembling the hull of a large ocean steamer, and this has received the name Great Western, in contrast with the Great Eastern, the vessel which laid the first Atlantic cable, and which was launched just before this was discovered in the cave.

VALLEY OF FLOWERS

Just beyond the Great Western we passed through the Valley of Flowers, a most beautiful and enchanting chamber, in which are mimic flowers of all sizes, forms and varieties. The last chamber of special interest in Silliman's Avenue is Ole Bull's Concert Hall. This is a spacious chamber with almost perfectly smooth walls and ceiling, and was so named because that famous Norwegian violinist once gave a musical concert here.

THE HANGING ROCKS

From Silliman's Avenue we entered into El Ghor, a very rough and rugged avenue, and near the entrance we passed under the Hanging Rocks. These are massive rocks directly overhead, supended by very small, neck-like fastenings of rock substance, and seem just ready to fall upon the heads of the tourists. This peculiar formation, like that of Bacon Chamber, was caused by the unequal solution of the rock substance in past geologic ages when water filled this avenue.

THE FLY CHAMBER

We next entered Fly Chamber. This chamber is rather wide but the ceiling is only a few feet above our heads. The walls and rocks here are covered with millions of black gypsum crystals resembling a house fly in size and form.

SHEEP-SHELTER AND VICTORIA'S CROWN

Next on our left at the height of about three feet, is a thin rock about twenty feet

long which juts out from the wall more than ten feet, and is called the Sheep-Shelter. Just to the right and a little farther on is a mass of rock nearly twenty feet in diameter and in shape closely resembles a crown. This is called Victoria's Crown.

MARTHA'S VINEYARD

Following El Ghor for about half a mile farther we come to Hebe's Springs, where we climb a rough stone stairway and enter Martha's Vineyard. Here a slender stalactite winds and curves from floor to ceiling and is called the Grapevine. Branching from this vine are numberless clusters of calcium, covered with black oxide of iron. These are such perfect mimics of real grape clusters that they almost offer a temptation to pluck them.

WASHINGTON HALL

We now enter Washington Hall, a large circular chamber, and find it to be one of the most attracting places we have seen since entering the cave. The feature of interest about this

hall is not its natural beauty or immense size, but that we here find a well prepared lunch awaiting us. I do not know who prepared it, or where it came from, but I know very well that we soon disposed of it in grand style, and after a rest of half an hour we were ready to pursure our journey of sight-seeing.

SNOWBALL ROOM

Snowball Room is the next object of interest beyond Washington Hall. The ceiling of this room is completely covered with hemispherical masses of white gypsum, looking exactly as if thousands of snowballs had been thrown against its surface, and were still clinging there.

CLEVELAND'S CABINET

We next entered Cleveland's Cabinet, a very long, wide and magnificent avenue, filled with dazzling alabaster brilliants of every form, color and size.

In this avenue we find perfect mimics of every flower that grows in forest, field, meadow, garden or prairie, making it a perfect fairyland

of lilies and flowers. Magnificent names are given to different portions of this avenue, all of them justified by the beauty and grandeur of the formations. Among these are Flora's Garden, Vale of Diamonds, Mary's Bower, Floral Cross, Marble Hall, Last Rose of Summer, Diamond Grotto, Gem Hall, and Charlotte's Grotto.

LAST ROSE OF SUMMER

One of the most beautiful and perfect of these cave flowers is a large white rose about one foot in diameter, whose alabaster petals curve gracefully outward from a central disk, looking as if nature had blended all her beauty and loveliness in this one rose. When Jenny Lind visited the cave in 1852 she stood directly under this flower and sang, with all the sweetness of her soul, "The Last Rose of Summer," and since that time this beautiful cave flower has been called "The Last Rose of Summer."

ROCKY MOUNTAINS

From this paradise of flowers, lilies, rubies and gems, we ascend an almost impassable

mountain of loose rocks which our guide called the Rocky Mountains. This immense mountain pile was formed in ages past when millions of tons of rocks "tumbled down" from the ceiling of the avenue to the floor beneath. At the summit of this rugged mountain we found ourselves in a very large and lofty hall which has been named Call's Rotunda. At this point the guide informed us that we were nearer to the surface than we had been since entering the cave. He also said that at this point faint rumblings of the trains on the L. & N. railroad had been heard.

CROGHAN'S HALL

From the Rotunda we could look down into a deep, gloomy gorge, known as the Dismal Hollow. Extending from the Rotunda on the left is an avenue leading directly to Croghan's Hall. This room is about sixty feet in diameter and thirty feet high, and in it are many very large and beautiful stalactites, some of them defaced by vandalism.

THE MAELSTROM

Just to the right, and near the wall, is a ragged, black, deep, yawning pit, called the Maelstrom. This dark and gloomy chasm is said to be one hundred and seventy-five feet deep, and in appearance is very much like the Bottomless Pit. Only a few daring persons have ventured to descend its gloomy depths, and these have found no avenues leading off from the bottom of sufficient size to admit passage any farther.

END OF THE CAVE

We are now at the end of our subterranean journey, as Croghan's Hall is the termination of the Mammoth Cave as it is known at the present. The avenue is here completely closed by a massive, compact stalactite called Serena's Bower. There is no other way out except that by which we entered untill we have returned to the Corkscrew. Retracing our steps we pass again through the shining crystaline gardens of Cleveland's Avenue, through El Ghor and Silliman's Avenue, pass Echo River again by

boat, recross the River Styx by the Natural Bridge, and are soon at the great Corkscrew, ready to make the ascent.

THE CORKSCREW

The Corkscrew is one of the most peculiar and wonderful scenes within this great underground world, and the passage through it is very difficult to make, especially at the end of the long tour through the cave. It is a huge mass of broken limestone blocks and ledges, filling an immense and irregular dome or pit, all tumbled together in a confused and irregular manner, as if the San Francisco earthquake had visited the place. Upward for a distance of fifty or sixty feet we climbed, crawled, and squeezed through the narrow openings, crevices and fissures, untill we finally made our exit near the great Kentucky Cliffs. We are now in the avenue which leads us directly to the Rotunda. Passing this we enter again into Hutchin's Narrows, and are soon at the great iron gate which our guide unlocks, and through

BAYARD TAYLOR

which we pass into the light of the world above.

BAYARD TAYLOR'S VISIT

A visit to the Mammoth Cave ought to be taken by every lover of the beautiful and sublime in nature. Bayard Taylor, the great American author and traveler, declared that he had never seen anything that would compare in beauty, wonder and sublimity with the Great Mammoth Cave. In speaking of his visit he said: "I have been twelve hours underground, but I have gained an age in a strange and hitherto unknown world—an age of wonderful experience and an endless store of sublime and lovely memories. Before taking a final leave of the Mammoth Cave, however, let me assure those who have followed me through it that no description can do justice to its sublimity or present a fair picture of its manifold wonders. It is the greatest natural curiosity I have ever visited, Niagara not excepted, and he whose expectations are not satisfied by its marvelous avenues, domes and starry grottoes must either be a fool or a demigod."

CHAPTER IV.

Process of Cave-Making

GEOLOGICAL

IN order that the reader may have a better understanding of the processes by which great caves have been formed, a brief sketch of the geological processes by which the earth's crust has been formed seems necessary, the two processes being only different phases of the same forces. In this brief sketch only a few of the leading facts connected with these processes can be given.

Geology is the science which treats of the rocks composing the crust of the earth, of their composition and structure, how they were originally made, and how they have been modified to bring them to their present condition. Historical geology is the phase of geological science which considers the stratified rocks in

their regular chronological order, and the progress and advance of animal and vegetable life upon the earth's surface as recorded by the fossil remains found in different strata of the rocks.

The geologist studies the natural changes that are now taking place on the earth's surface, and the causes which bring them about, in order that he may understand more clearly the changes that have occurred in the past. In this way he becomes familiar with all the agencies that have fashioned the face of our planet in its present variety of forms, and he is now able to read with much accuracy the history of the earth and the successive forms of animal and vegetable life as they appeared upon it, and their evolution from primitive types to their present forms of perfection.

The rocks of the earth's crust are of two general classes,—igneous and sedimentary. The igneous rocks are composed of different materials but are all of volcanic origin, having been ejected at different periods of the earth's history.

The sedimentary rocks always occur in layers or strata, and for this reason are generally called stratified rocks. In their origin the stratified rocks are either aqueous,—formed by the action of water; aerial,—formed by the action of air; chemical,—formed by chemical action; or organic,—formed from vegetable or animal matter. The latter two of these are the ones mostly involved in the making of the great caverns of the earth, of which the Mammoth Cave is greatest.

AGE OF THE EARTH

The age of the earth, since stratification began, may be estimated with some degree of accuracy by observing the rate of sedimentary deposit in the sea. This rate of deposit has been estimated by the best geologists to be about one foot in every twenty-five hundred years. As the thickness of the stratified rocks of the earth's crust, including all the different formations at their greatest thickness, is perhaps forty miles, the time necessary to produce these formations must reach back hundreds of millions of years.

Geological Divisions of Time

The following outline represents the divisions of geological time adopted by most geologists. Four grand divisions of time, called eras, are divided into ten periods, and these in turn are divided into a varying number of epochs.

ERAS	PERIODS	EPOCHS
Cenozoic	Quaternary	Recent
		Glacial
	Tertiary	Pliocene
		Miocene
		Eocene
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Carboniferous	Permian
	Devonian	Pennsylvanian
	Silurian	Mississippian
	Ordovician	
	Cambrian	
Azoic		

In this outline it should be remembered that

the largest assemblages of rock formations are called groups, and the divisions of time during which they were formed are called eras. These groups are subdivided into ten systems, and the divisions of time during which the systems were formed are called periods. The systems are subdivded into various series, and the corresponding divisions of time are known as epochs. The name given to each essemblage of formations is also given to the corresponding divisions of time. Thus we speak of the Paleozoic group of rocks, meaning a certian assemblage of formations very similar in their organism; and of the Paleozoic era, meaning the time during which they were deposited. In the same way we speak of the Silurian rocks and the Silurian peroid, of the Permian rocks and the Permian epoch.

THE AZOIC GROUP

The Azoic group comprises the oldest of the known sedimentary or stratified rocks, and mingled with these are great quantities of igneous

rocks. Many of the best modern geologists hold the theory that these igneous rocks, when in a molten state, were intruded among the sedimentary rocks through crevices and breaks caused by internal forces. The upper part of this group, which is sometimes called the Algonkian group, is composed of more clearly defined stratified rocks than the lower part, which is sometimes called the Archean group. The upper part of the Azoic group is partially exposed to view in some parts of the Lake Superior region, and especially in the deep gorges of the Grand Canyon of the Colorado. The greatest deposits of iron and copper ore are found among the upper rocks of this group. Only a very few of the slightest traces of vegetable or animal fossils have been found among the rocks of this group, and these are of the crudest primitive kind; and for this reason the name Azoic (without life) has been given to this group. The old names Archean and Algonkian are still used by some geologists.

THE PALEOZOIC GROUP

The Paleozoic group rests next above the Azoic. The time required to deposit these formations, although much shorter than the Azoic, must be reckoned in millions of years. During this era there was a marked advance in life organism, both animal and vegetable, as shown by the fossil deposits, more than five hundred species of invertebrates being represented.

The Paleozoic formations are arranged in five systems, in the following order: Cambrian, Ordovician, Silurian, Devonian, Carboniferous. The first three of these systems are sometimes called the older Paleozoic, and the last two the later Paleozoic.

The Cambrian System

The rocks of the Cambrian system are widely distributed over nearly all of the American continent, although the outcrops are limited to rather small areas. Coarse sandstones, shales, and heavy beds of limestones form the principal deposits.

The Ordovician System

The Ordovician rocks are located immediately above the Cambrian system, and as the two systems are closely united, it is certain that no great internal forces were in action during their formations. The fossil remains of the Ordovician rocks show that great advances had been made in both animal and vegetable life.

The Silurian System

The Silurian rocks are evidently of shallow-water deposits, and in some places reach a total thickness of several thousand feet, while in other places the formations are only a few feet in thickness. The region of the Mississippi valley was covered with a rather shallow and quiet sea during the Silurian period, and this sea was well adapted to the formation of limestone, as it was surrounded by low lands from which it received little waste. It was during this period that the blue limestone formations were deposited through which the solvent waters have carved the great Mammoth Cave. Animal and veg-

etable organism advanced very rapidly during the Silurian period.

The Devonian System

The rocks of the Devonian system rest conformably upon the Silurian system, and this closely related position testifies that no great uplifts of the continents, or mountain-making forces, occurred during these formations. The rocks of this system consist principally of sandstones, shales, and limestones. Numerous vertebrate animals appeared during this period, and these are doubtless the ancestors of all the swarming hosts of the vertebrates of today. Vegetable life also made great advances during this period, and we here find the fossil remains of extensive and luxuriant forests for the first time.

The Carboniferous System

The Carboniferous system rests above the Devonian, and as the strata of the two systems conform to each other rather closely, it is evident that no great physical disturbances occurred during these formations. The conditions for

the formation of vast coal deposits were extremely favorable during this period, and it was at this time that the great coal beds of our own country originated.

During this period the climate was very warm, and the surface was shallow water, or a marshy plain. Extensive and luxuriant forests of a tropical nature, dense undergrowths, vast jungles of carboniferous ferns, and immense thickets of various other coal-producing plants all continued to accumulate for hundreds of thousands of years upon this low, marshy plain. The sediments from this shallow water continued to accumulate and cover these deposits, and when the surface was emerged from the sea this sediment overlaid the vegetable deposits at variable depths. During the vast lapses of time that have intervened since these deposits, chemical action has changed them into bituminous and anthracite coal. Animal life made as great advances during this period as did the vegetable. This system includes three distinct series,—the Mississippian,

the Pennsylvanian, and the Permian,—and the principal deposits, besides the coal, are sandstones, limestones, shales, and fire clay.

THE MESOZOIC GROUP

The Mesozoic group is next in order above the Paleozoic, and the time required for this formation was much shorter than the Paleozoic era, yet it extends through millions of years. There are three systems comprised in the Mesozoic group,—the Triassic, the Jurassic, and the Cretaceous.

The Triassic System

The rocks of the Triassic system are different varieties of sandstone, and contain no sea fossils. The formations are about one mile in thickness, and some of the layers are ripple-marked, and contain tracks of reptiles.

The Jurassic System

The rocks of the Jurassic system are next above those of the Triassic, and are chiefly shale and slate, intermingled with various lava deposits in many places. These are exposed to view in

numerous places in the Sierra Nevada Mountains.

The Cretaceous System

The rocks of the Cretaceous system are principally limestone, and they reach a thickness of more than a thousand feet in many places. These limestone rocks rest directly on the formations of the Jurassic system, but in a few localities where no Jurassic formations occur they rest unconformably on the Triassic sandstones.

During the era of the Mesozoic formations there was a more marked advance in animal life than during any previous era. It was during this time that some of the most wonderful animals of land and sea flourished. Petrified and fossil remains of these great monsters of the sea and flying dragons of the air are frequently found among the deposits of this era. It was during this era that the first uplifts of the Rocky Mountains and the Cordileras occurred.

THE CENOZOIC GROUP

The formations of the Cenozoic group com-

prise the uppermost strata of the earth as it exists today. The rocks of this group rest unconformably upon those of the Mesozoic group. This unconformable condition is the result of the physical disturbances that occurred during this time. It was during this era that the higher orders of animals appeared, and for this reason the era is sometimes called the Age of Mammals. Vegetable life made as great advances during this era as did animal life, and included most of the genera of the present. The Cenozoic era comprises two periods,—the Tertiary and the Quaternary.

The Tertiary Period.

The rocks of the Tertiary period are principally limestone, sandstone, and shale. The strata are found in the lowlands of the Gulf states, the narrow coastal plains of the Atlantic, the valley of the Columbia river, and the valleys about Puget sound. But in Utah and Colorado the same starta are found more than five thousand feet above sea level, showing that uplifts occur-

red during this period. The fact that Tertiary limestone, which is of marine formation, is found near the summits of the Alps, the Pyrenees, the Caucasus, and the Himalayas, is evidence that these lofty mountains received most of their uplift during the Tertiary period.

Intense Volcanic Action

This period was also noted for violent and intense volcanic action on all the continents. In North America most of the western basins were filled with lava flow from the numerous active volcanoes, many of these lava beds being five thousand feet in thickness. Historic Vesuvius, then a submarine volcano, broke forth for the first time, and with short intervals of inactivity has remained an active volcano. Since its first eruptions, the mountain-making forces have raised it to its present height.

The Quaternary Period

The Quaternary period, the last one of geological history, began with the appearance of the higher order of mammals that exist today,

and extends to the present time. It was within this period that man, the crowning glory of God's creation, made his appearance on earth. This period is divided into two distinct epochs,—the Glacial and the Recent.

The Glacial Epoch

The hot tropical climate of the Mesozoic era and the milder climate of the Tertiary period had now passed away. These climates were followed by a succession of frozen ages during which all of the northern parts of North America, and much of Europe, were covered with immense ice sheets, similar to those that cover Greenland today.

Glacial Action

As these vast glaciers moved slowly over the face of the earth they cut and carved the surface in various ways, ground the rocks to pieces beneath their great weight, filled up valleys and waterways, changed the courses of rivers, and left great hills of waste in their course in the form of drumlins, moraines, terraces,

and many other formations that exist at this day.

When the climate again modified and these ice sheets melted away, they left the surface deposits somewhat as they are found today. By a careful study of the records in these deposits of drift we may read the history of the Glacial epoch with as much accuracy as we read the history of former epochs by their fossil deposits in the rocks.

The Recent Epoch

The gradual melting of the great ice sheets of Europe and North America ended the Glacial epoch, and quietly ushered in the Recent epoch, which reaches from that time to the present. The time required for these vast fields of ice to entirely disappear was so infinitelv great that the two epochs gradually blend into each other.

It has been during the Recent epoch that the greatest advances in the world's history have occurred. Man has advanced from his primitive state of barbarism and savagery to the higest attainments of social, moral, and religious life.

His achievements are so wonderful, his powers so extensive, his possibilities so nearly unlimited that he bears marks of kinship to Him in whose image he was created; and to learn of his progress and wonderful works on earth, geology gives way to history.

CAVE-MAKING

From the preceding brief sketch of the processes by which the earth's crust has been formed, the reader may readily understand the processes by which great caverns are made. These great caverns are formed only in localities where conditions are favorable for cave-making. Kentucky occupies a portion of the largest cave region known to the world today. This extensive region of caves, sink holes, and subterranean streams, extends far into Indiana on the north, and throughout the greater portion of Tennessee on the south, a portion of it even extending into Georgia, where, at the foot of the Raccoon Mountains, is located the great Nicojack Cave. Within this cave region are located

many of the largest and most beautiful caverns of the world, the most wonderful of them all being the famous Mammoth Cave in Edmondson county, Kentucky.

Necessary Conditions

One of the most essential conditions for extensive cave-making is the presence of limestone rocks. The oolitic limestone, through which the avenues and channels of the Mammoth Cave have been carved, was deposited during the Silurian period, when the sea covered this part of the continent. This limestone was formed from the calcareous, powdered particles of corals, marine shells, and other similar animal remains. As it contains large quantities of lime carbonate, it yields readily to the solvent action of water, and for this reason is sometimes called "cavern limestone."

Thickness of Strata

The blue Silurian limestone in the region of the Mammoth Cave reaches a known thickness of nearly three hundred and fifty feet, this being

the vertical distance between the highest and lowest chambers of the cave. The waters of Echo River and the River Styx occupy the lowest levels of the cave, and have their channels in this limestone; and how far below the waters of these streams the limestone extends we have no means of knowing. The total thickness is perhaps four hundred feet, and the time necessary for its formation not less than a million of years.

Horizontal Strata

The limestone strata exposed to view within the various chambers and domes of the cave usually rest in a horizontal position, being only slightly tilted in a very few places. From this condition it is evident that this region was practically free from any violent internal upheavals during the period in which this limestone was deposited. This undisturbed condition of the limestone strata was a favorable feature in the formation of the Mammoth Cave, as it permitted a free circulation of the solvent water during the time it was carving the immense

channels, avenues, and chambers throughout the cave.

Kaskaskia Sandstone

Just above the limestone, in most places in the vicinity of the cave, is a rather hard, compact layer of Kaskaskia sandstone. As this sandstone does not yield to the chemical action of water, it forms a kind of protecting roof above the limestone, and prevents the free passage of surface water to the limestone beneath. This impervious roof of sandstone has greatly retarded the cave-making process, and has, to a great extent, modified the formations within the cave.

Solvent Action of Water

When rain water falls on the surface it gathers into itself great quantities of acids, —principally carbonic,—from the air, the soil, and decaying vegetable matter. With this additional solvent power the water seeps downward to the limestone starta, through any natural openings or passage ways, and immediately begins its attack on the solvent oolitic limestone

rocks. The work of erosion is rapid or slow according to the condition of the rocks on which the water acts, the oolitic limestone being the most easily dissolved.

Forming Channels.

As the limestone is eaten away, channels begin to form through which the water can pass more readily. Through these channels,—very small at first,—the water continues to pass, carving them wider and deeper, and carrying with it the mineral burden taken from the solvent rocks, until it has found or made a place of exit, and usually emerges at the foot of some hill, or in the channel of some river, as a clear, running spring, sometimes of enormous size. This process is continued throughout countless ages, until the whole limestone region becomes honeycombed with cavern channels passing in all directions, and of various forms and sizes.

Insoluble Rocks.

Mingled with the soluble oolitic limestone in this region, are other kinds of rocks and

other grades of limestone of a harder and less soluble nature. These harder portions resist the action of water to a very great extent, and this causes the avenues, chambers, and galleries within the cave to be very irregular and unsymmetrical in size and form. The effect of this unequal solution of rock substance is very marked at the Hanging Rocks, Bacon Chamber, Serpent Hall, Sheep Shelter, Great Western, Pigeon Boxes, Victoria's Crown, Lover's Leap, and many other places throughout the cave.

Sink Holes

Sink holes always abound in regions of limestone caverns. These are usually formed by the solvent action of the water as it percolates through the limestone joints and crevices, enlarging them into concave and funnel shaped pits or swallows. Through these openings the surface water readily passes to the subterranean channels beneath. Sometimes the roof of an extended cavern will become so weakened from erosion that it can not support itself, and a

breakdown then occurs, forming a low, sunken valley, which is really a sink hole on a large scale. Many of these large sink holes, or sunken valleys, are found in the region of the Mammoth Cave, some of them containing hundreds of acres of fine farming lands.

Stalactites

While the chemical action of the water is constantly enlarging the avenues in all the wet regions of the cave by erosion, it is at the same time filling them up at certain places by a different process. In the higher levels of the cave, where the water from the surface can reach the avenues more easily, great clusters of stalactites and stalagmites are being formed, some of them of immense size and of great beauty. As the water filters down through the limestone above, it becomes laden with mineral substances,—principally gypsum in various degrees of purity. As this mineral water drips from the walls and ceiling of the cave, each drop deposits a portion of its mineral burden, forming

inverted, pendant cones, similar in form to the icicles made by dripping water in the winter, and these formations are called stalactites.

Stalagmites

When the water has deposited a portion of its mineral burden on the lower tips of the stalactites, it falls to the floor beneath and forms deposits of the same material, but usually a little thicker and not so pointed, and these are called stalagmites. These stalactites and stalagmites continue to grow, the stalactites downward, and the stalagmites upward, until they sometimes meet and form immense colums or pillars, as if to support the limestone ceiling above. Among the colums of this kind are the three pillars of the Bridal Altar, the Post Oak Pillar, the Pillar of Hercules, the Lone Sentinel, the beautiful Jenny Lind Armchair, and numerous others throughout the upper levels of the cave. The largest formation of this kind within the cave is Serena's Bower, which completely closes the avenue just beyond Croghan's Hall, terminat-

ing the cave in that direction.

Tumble-Down

When the top layers of limestone are dissolved and carried away by the action of the solvent water within the cave, the sandstone cap still above is left without sufficient support, and in many places these sandstones break away in huge masses, tumbling into the avenues beneath, sometimes closing the passage entirely, and sometimes forming great mountains over which the tourist must pass in exploring the cave. Such a mass of detached rocks is called a "tumble-down." Limitation Hill, which closes the avenue at Lover's Leap, is an immense "tumble-down," and another similar mass closes Audubon Avenue just beyond Olive's Bower. The most extensive "tumble-down" within the cave is at Call's Rotunda, and has been named Rocky Mountains. This vast pile of rocks does not entirely close the avenue, and tourists pass over it to visit Croghan's Hall, where the avenue is completely closed by Serena's Bower.

Green River

Green River, the only surface stream in the vicinity of the Mammoth Cave, flows through a greater portion of the cave region of Kentucky. This river has cut a deep channel in the limestone through which it passes, and is navigable for small steamers as far as the mouth of the Mammoth Cave, near which it passes. It has no surface streams for tributaries within the cavern region, but is fed exclusively by underground streams. It is evident that Echo River within the cave is connected with Green River by some subterranean channel, as their waters always rise and fall simultaneously.

Dry and Wet Regions

In many regions of the cave the avenues and chambers extend for miles in a perfectly dry condition. In these dry regions the process of cave-making has ceased entirely, and if never disturbed by any forces that will turn the water into them again, these regions will remain until the end of time just as they are today.

In many other regions in the cave the waters are still at work, forming stalactites and stalagmites, cutting into the limestone walls, and channels, changing the size and form of the avenues, chambers, and galleries of the cave, just as it has been doing through the countless years since the cave began its formation. It will be for remotely future ages to witness the final form, size, and fashion of this, the largest and most sublime of nature's subterranean wonders.

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